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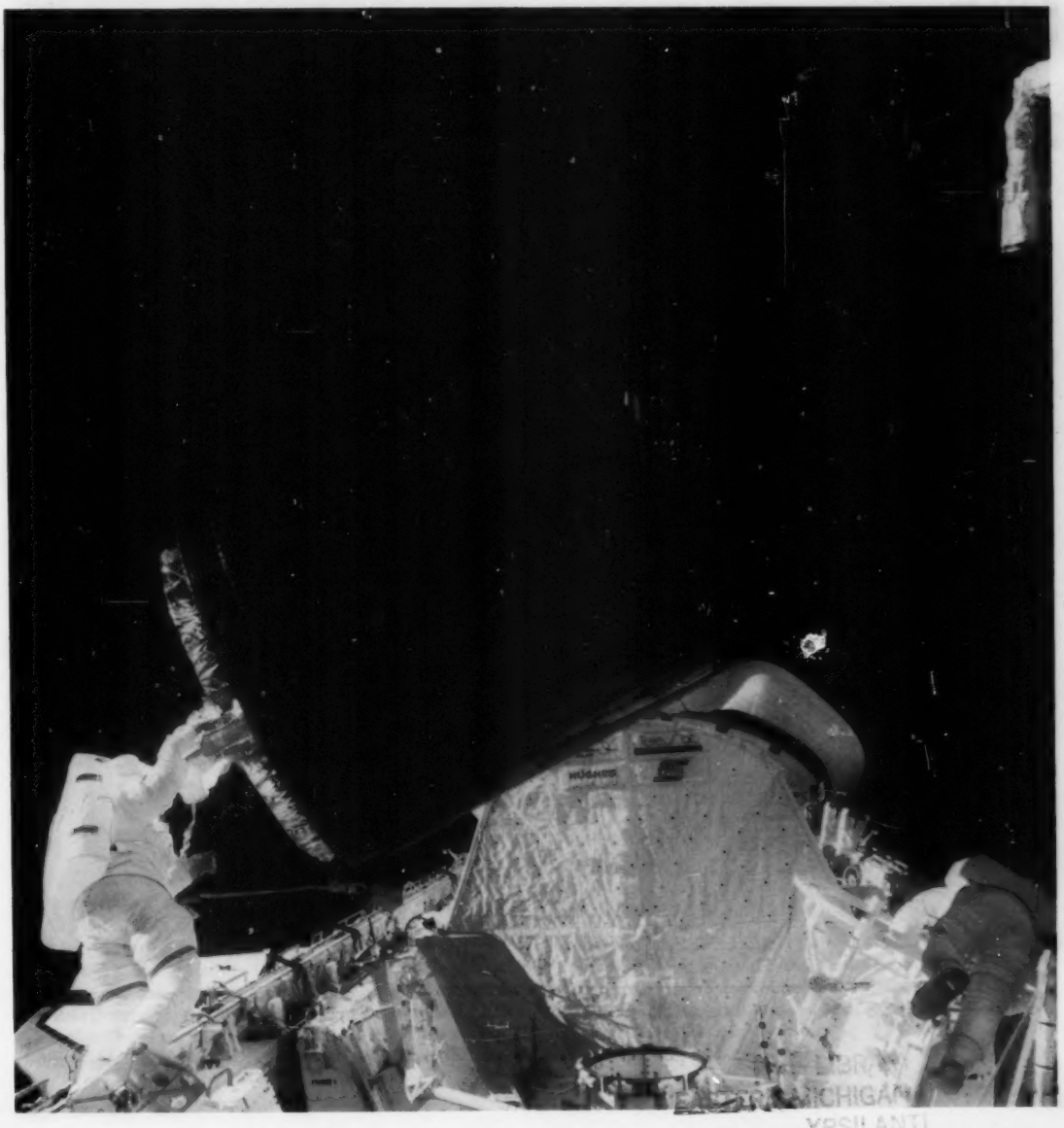

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About the Cover

Shuttle mission 51-A, the second flight of orbiter Discovery, in November, was highlighted by the retrieval of two wayward satellites, Palapa B-2 and Westar IV. The two communications spacecraft were deployed during flight 41-B in February 1984, but did not reach operational orbits due to failures in their Payload Assist Module rocket nozzles.

In the cover photo, mission specialist Joseph P. Allen, tethered to the orbiting Discovery while holding the Palapa B-2 satellite, became the first human in history to hold a 1,200-pound communications satellite up for one trip around the world.

At right, astronaut Dale A. Gardner returns the "stinger" device to its stowage area. The stinger was used earlier by Allen to dock with and stabilize the previously stranded spinning satellite.

Mission 51-A pictorial highlights are featured in this issue beginning on page 6.

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NASA Nets Show Proficiency in Problem-Solving

NASA Emploiyee Teams (NETS) — or quality circles — have become proficient in identifying work-related problems and presenting solutions to management, according to a status review meeting held in October at Goddard Space Flight Center's Wallops Flight Facility, Wallops Island, Va. The three-day meeting brought together 10 NET coordinators and consultants from Martin Marietta Aerospace, Michoud Division, New Orleans.

Employee teams ranging from engineering, space and computer sciences to administration and blue collar trades are identifying work-related problems and proposing solutions to management. This approach to participative management and team building is based on the institutional goal for improved quality and productivity.

In the past year, NASA's number of employee teams has increased and it is anticipated the number will reach 100 agency-wide by the end of this month.

Achievements of NASA quality circles this year include:

Ames Research Center, Mountain View, Calif. — Scientists in the Space Science Division integrated experiments on aircraft, planned missions to be flown and conducted comparison of data at the end of each mission, culminating in a series of procedures to prevent crisis management.

Goddard Space Flight Center, Greenbelt, Md. — Revised procurement lead times.

Jet Propulsion Laboratory, Pasadena, Calif. — Integrated marketing plan in an unstable environment.

Johnson Space Center, Houston — Reduced time and money spent on processing purchase orders (estimated annual cost savings, $79,671).

Kennedy Space Center, Fla. — Improved automatic data processing systems and ongoing development of NASA/contractor integrated teams.

Langley Research Center, Hampton, Va. — Increased plant and equipment efficiency and improved training for mechanics and technicians.

Lewis Research Center, Cleveland — Established a management information system for use in the Resource Analysis and Management Office.

Marshall Space Flight Center, Huntsville, Ala. — Retrieved engineering design information from computer-aided design system.

NASA NET meeting participants: Standing (from the left) Bill Reynolds, Marshall Space Flight Center; Dale Crossman, NASA Headquarters; Ralph Tortorich, Martin Marietta; Glade Woods, National Space Technology Laboratories; Irwin Schauer, NASA Headquarters; Alma Martin, Johnson Space Center; Marco Giardino and Enos Cozier, Martin Marietta; Walter Baleyko, Kennedy Space Center; Christine Dreyfus, Martin Marietta; Steve Rohr, Marshall Space Flight Center; and John Leveen, Ames Research Center. Seated: Marilyn Gist, Goddard Space Flight Center; Leo Lunine, Jet Propulsion Laboratory; Lyn Stabler, Martin Marietta; Debra Griest, Lewis Research Center; Eugene Kelsey, Langley Research Center; Joyce Beattie, NASA Headquarters; and C. M. "Skip" Cole, Langley Research Center.

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National Space Technology Laboratories, Miss. — Established NASA record-keeping procedure. NASA/contractor teams also have resolved numerous problems to each other's mutual advantage.

NASA Headquarters, Washington, D.C. — Clarified analysts' roles and responsibilities and improved interoffice communications.

Hubble Space Telescope Optics Arrive in California

The optics for a NASA telescope so powerful that it may enable scientists to see to the edge of the known universe arrived on the west coast on Nov. 1, where it will be integrated with the other telescope components and prepared for launch aboard the Space Shuttle in 1986.

The Optical Telescope Assembly for NASA's Hubble Space Telescope was transported from its manufacturer, the Perkin-Elmer Corp., Danbury, Conn., to the Lockheed Missiles and Space Co., Sunnyvale, Calif. Much of the trip was by Super Guppy, a NASA aircraft specially modified to carry oversized cargo.

The 10-foot diameter, 30-foot long assembly, which consists of the primary and secondary telescope mirrors, associated electronics and supporting structure for the telescope's instruments, left Perkin-Elmer by truck Oct. 29, and was flown from Stewart Airport, Newburgh, N.Y., Oct 31.

At Lockheed, the assembly will be integrated with sensitive scientific instruments shipped earlier and with other Lockheed-supplied spacecraft components, then checked out, and prepared for shipment to the Kennedy Space Center, Fla., for launch.

A special flatbed truck carrying the Optical Telescope Assembly leaves the Perkin-Elmer facility in Danbury, Conn., for its cross country journey to Lockheed Missiles and Space Co. in Sunnyvale, Calif.

"The move went flawlessly," said Jim Odom, Space Telescope project manager at NASA's Marshall Space Flight Center, Huntsville, Ala. "Things went so smoothly in fact, that we completed the move ahead of schedule."

The overall telescope, 43 feet long and weighing more than 25,000 pounds, will become the largest scientific payload ever placed in Earth orbit.

From its vantage point 320 nautical miles in altitude and above the Earth's distorting atmosphere, the telescope will enable scientists to see some 14 billion light years and to observe celestial objects some 50 times fainter than now possible. Some scientists have termed the telescope the greatest advance in astronomy since the invention of the simple telescope almost four centuries ago.

The Marshall Space Flight Center, Huntsville, Ala., has overall management responsibility for the Hubble Space Telescope project. Science instrument development was led by NASA's Goddard Space Flight Center, Greenbelt, Md. Once in orbit around the Earth, the telescope's astronomical research work will be guided by Goddard and the Space Telescope Science Institute in Baltimore, Md.

Hearth Leaves Langley, Petersen Named Director

Dr. Donald P. Hearth will leave his post as director of the Langley Research Center, Hampton, Va., at the end of this month. Richard H. Petersen, Langley Deputy Director, has been named as his successor, effective Dec. 3, 1984.

"I regret Don Hearth's decision to leave NASA," said James M. Beggs, NASA Administrator, "but I am confident that Pete Petersen will provide the same high caliber of leadership as his predecessors have at Langley. Upon his departure, I have asked Dr. Hearth to assist me for 60 days during this critical period in the establishment of the Space Station program, expansion of private sector involvement in civil space activities and the development of new markets for the Space Transportation System."

Hearth has been center director at Langley since September 1975. He joined NASA in 1962 and has held various agency positions including deputy director of the Goddard Space Flight Center and director of Planetary Programs at NASA Headquarters. Prior to joining NASA, Hearth was at the Marquardt Corp., Van Nuys, Calif., and the Lewis Research Center, Cleveland, when it was part of the National Advisory Committee for

Donald P. Hearth

Richard H. Petersen

Aeronautics, NASA's predecessor. He was awarded NASA's highest award, the Distinguished Service Medal, in 1975.

Petersen has served as Deputy Center Director at Langley since July 1980. He began his career at NASA's Ames Research Center, Mountain View, Calif., in 1957 and was chief of the Aerodynamics Division at Ames from 1975 until he joined Langley.

Teacher to Fly on Early 1986 Shuttle Mission

NASA, in conjunction with the Council of Chief State School Officers, has released the Announcement of Opportunity (AO) specifying the eligibility requirements for selection of a teacher in NASA's Space Flight Participation Program.

Through the program, NASA will extend Shuttle flight opportunities to a wide segment of private citizens with the purpose of communicating the experience of space flight to the public through educational and information programs. NASA eventually intends to fly various categories of Space Flight Participants two to three times per year.

President Reagan announced last August that an elementary or secondary school teacher would be the first Shuttle passenger under NASA's new Space Flight Participant Program.

Teachers meeting the requirements may request an application packet from the NASA Teacher in Space Project, Council of Chief State School Officers, 400 North Capitol Street, N.W., Suite 379, Washington, D.C. 20001. The application period is from Dec. 1, 1984, to Feb. 1, 1985.

The opportunity is open to elementary and secondary level teachers in all public, private and parochial schools in the United States and U.S. territories, and in Department of Defense overseas dependents schools and Department of State overseas schools and in the Bureau of Indian Affairs. The teacher must:

- Be a U.S. citizen;
- Be a full-time classroom teacher;
- Have been a full-time classroom teacher for the past five years;
- Provide verification of teacher eligibility and consent to participate which will be included in the application packet;
- Meet all medical requirements as defined;
- Not be a spouse of a current or former NASA employee.

The school in which the teacher teaches, if it is non-public, must advertise that it does not discriminate in admissions based on race.

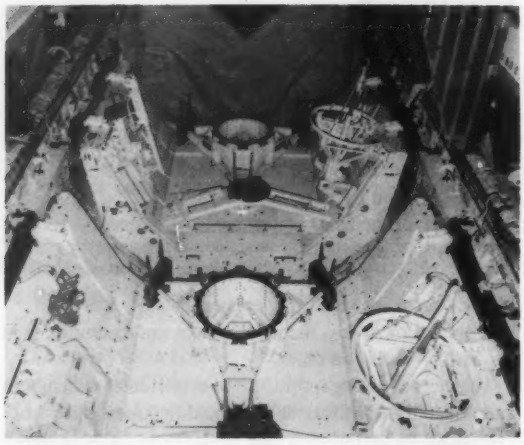
Teachers applying for this flight opportunity will submit an application to illustrate their qualifications and excellence as an educator and to demonstrate how they would share the experience with the public.

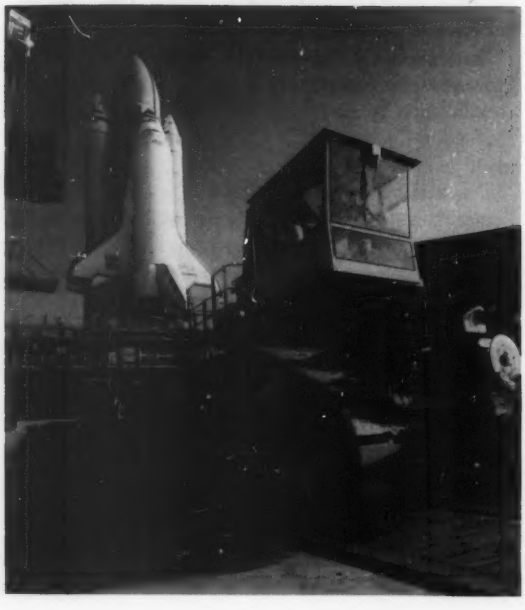
All applications received will be screened to eliminate those not meeting the basic requirements. Remaining applications will be forwarded to State Review Panels which will evaluate the proposals and select two teachers per state as nominees. The 120 nominees (two per state, plus U.S. territories, Departments of Defense and State dependents schools and Bureau of Indian Affairs schools) will be forwarded to a National Review Panel for further evaluation. All state nominees will attend a teachers' workshop and recognition banquet in the summer of 1985 in Washington, D.C. The workshop will inform the participants of current developments in the space program, and applicants will undergo further evaluation and screening by the National Review Panel in the form of personal interviews.

From the state-level nominees, the National Review Panel will recommend ten teachers as semifinalists for consideration by the NASA Space Flight Participant Evaluation Committee. This Committee is comprised of seven senior NASA officials.

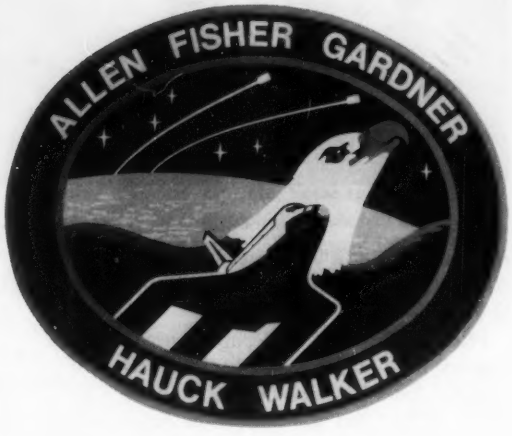
The semifinalists will go to NASA's Johnson Space Center, Houston, for thorough medical examinations, in-depth briefings and interviews by the NASA Evaluation Committee. Based on results of the physical examinations and the interviews, the Evaluation Committee will determine which applicants are qualified to undergo necessary training and will recommend five finalist candidates.

The names of the five finalists will be submitted to the NASA Administrator, who, along with the Evaluation Committee, will select the primary and back-up candidates to undergo training for space flight. The specific flight opportunity is under review; however, the goal is to fly the first teacher on a mission in early 1986.





Shuttle Mission 51-A — Pictorial Highlights



Crew: Frederick H. Hauck, Commander
David M. Walker, Pilot
Joseph P. Allen, Mission Specialist 1
Anna L. Fisher, Mission Specialist 2
Dale A. Gardner, Mission Specialist 3

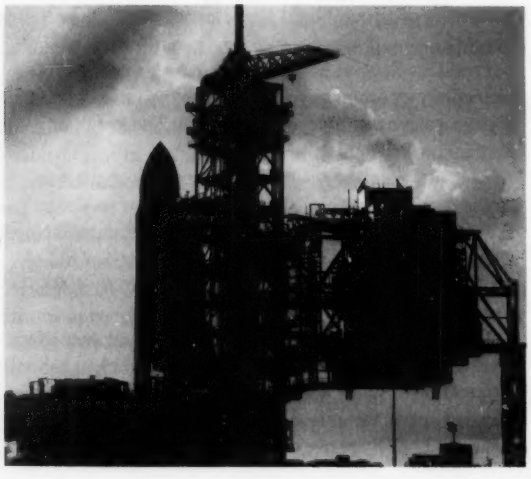
Orbiter: Discovery (OV-103)

Launch Site: Kennedy Space Center, Fla., Pad 39A

Launch Date/Time: Nov. 8, 1984; 7:15 a.m. EST

Orbital Inclination: 28.5 degrees

Altitude: 160 nautical miles (initially); 180-190 nm (retrieval)



Mission Duration: 7 days, 23 hours, 44 minutes, 56 seconds

Orbits: 126 full orbits; landing on 127th

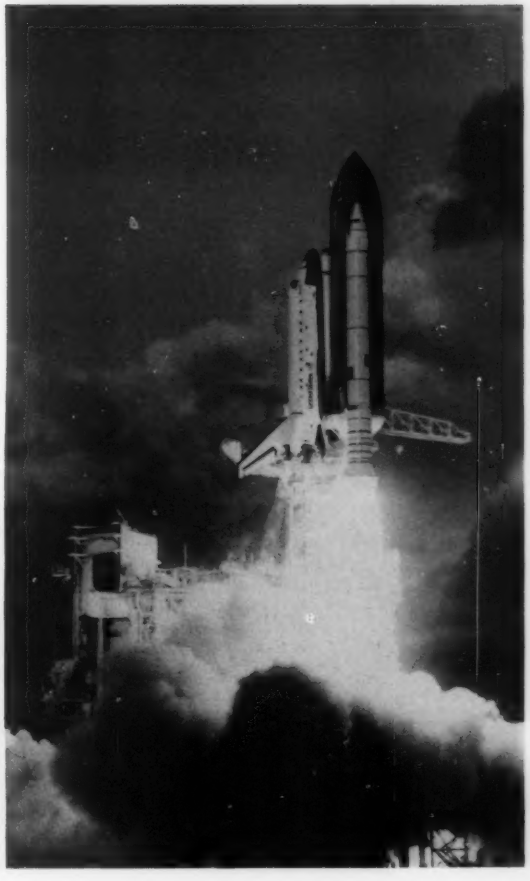
Miles Traveled: 2,858,365 nm

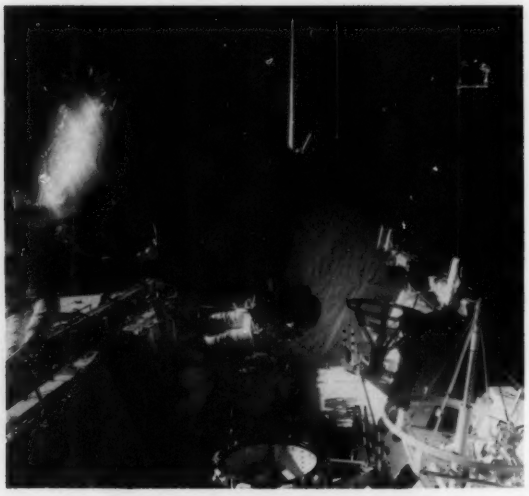
Landing Date/Time: Nov. 16, 1984; 6:59:56 a.m. EST

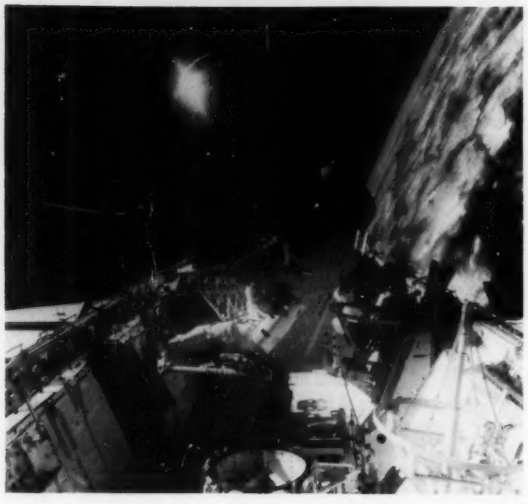
Landing Site: Kennedy Space Center, Fla., Runway 15

Highlights: Two satellite deployments — Telesat-H (Anik) and Syncom IV-2 (Leasat)
Two satellites retrieved from orbit and returned to Earth — Palapa B-2 and Westar VI

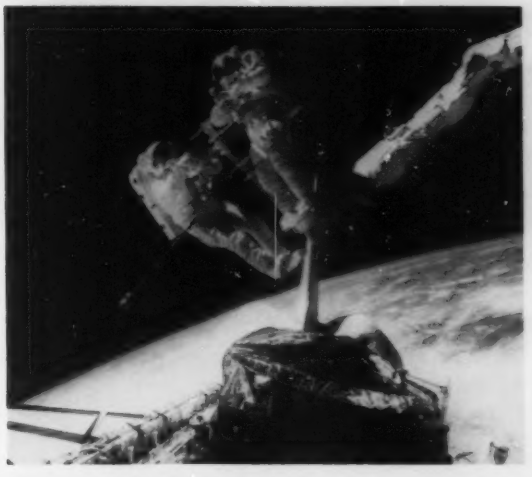
Page 6: Cargo bay shown with satellite retrieval pallets and Telesat H satellite (upper left); Discovery is towed to Vehicle Assembly Building (middle left); crawler transporter backs away 51-A Shuttle stack (lower left); 51-A bolted into place (lower right). Page 7: 51-A crew (upper left); liftoff (lower left, upper right, lower right).



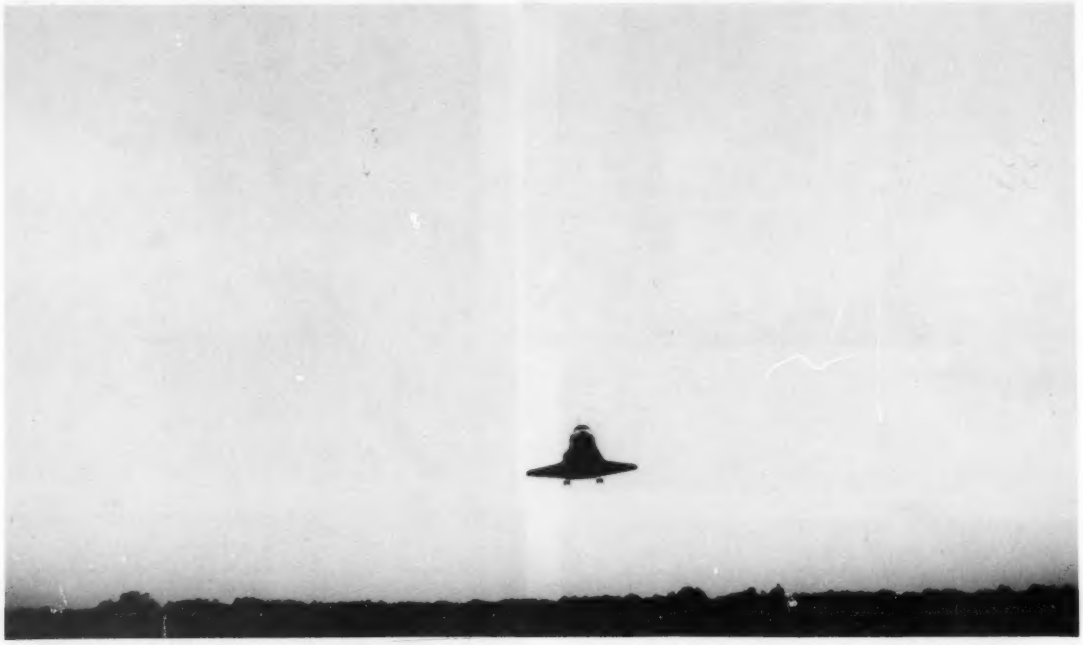




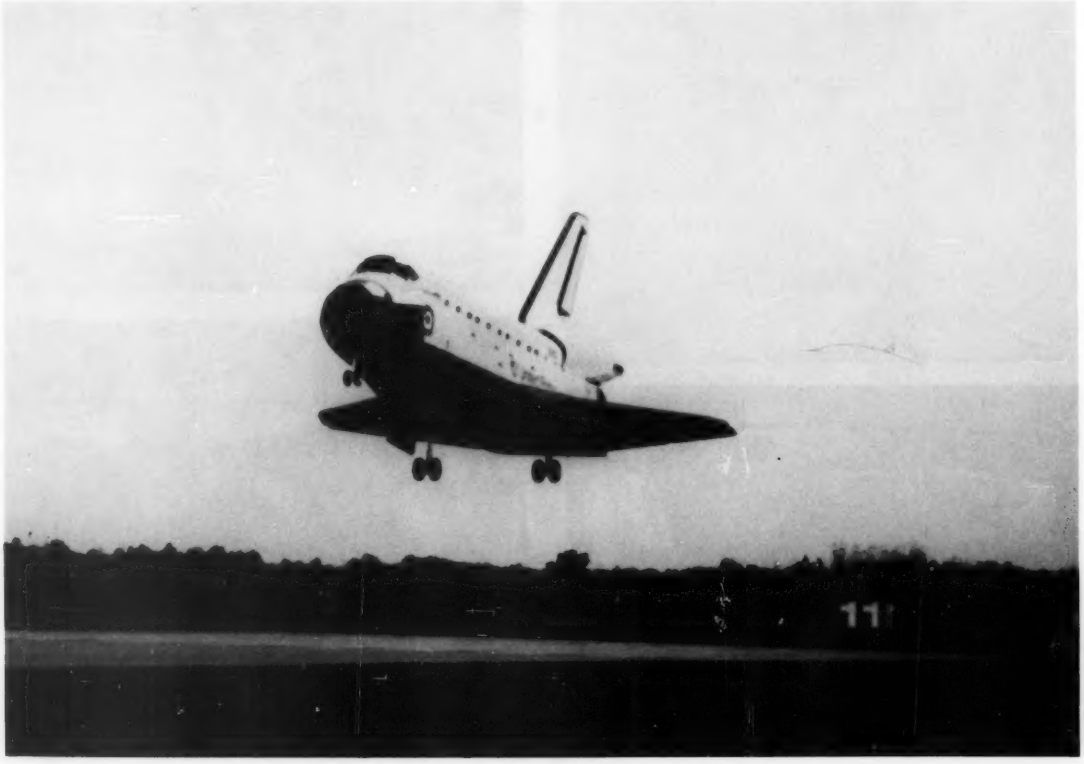
Page 8: In frisbee-type deployment, Leasat rises from the cargo bay (upper left); end effector of the Remote Manipulator System (middle left); Fisher operates robot arm for retrieval operations (lower left); Allen (left) and Gardner work to berth Palapa B-2 (upper right); Gardner hangs onto adapter for securing Palapa (lower right). Page 9: Gardner, tethered to Discovery, prepares to don Manned Maneuvering Unit (upper left); Gardner docks with Westar (middle left); Allen on the end of robot arm holds onto top of Westar (lower left); Gardner (left) and Allen work together at Westar (upper right); Gardner and Allen in post-retrieval activity (middle right); 51-A onboard crew portrait (lower right).



EAGLE
FLIES HIGH
2 UP
2 DOWN



Landing on Nov. 16, 1984, at Kennedy Space Center, Fla.



NASA Receives 13 Bids for Space Station Work

NASA has received 13 proposals from U.S. industry for definition and preliminary design of a permanently manned Space Station to be operational in low-Earth orbit early in the 1990s.

The submissions are in response to a Request for Proposal (RFP) issued Sept. 14, 1984. Deadline for submission was Nov. 15, 1984.

The RFP contained four "work packages" covering definition and preliminary design (Phase B) of Space Station elements. NASA plans to let competing contracts for each of the work packages and has scheduled April 1, 1985, as the effective date of the contracts.

Following is a listing of companies involved in proposals for the Space Station Definition and Preliminary Design activity received by the Source Evaluation Board at the Johnson Space Center, Houston, on Nov. 15, 1984. In each case the team leader is listed first. Other companies listed range from primary team members to subcontractors to advisors and are identified within the respective proposals. The order of listing has no significance with regard to a company's contribution to the respective proposal.

Work Package One: Marshall Space Flight Center, Huntsville, Ala. — definition and preliminary design of pressurized "common modules" with appropriate systems for use as laboratories, living areas and logistics transport; environmental control and propulsive systems; plan for equipping a module as a laboratory and additional ones as logistics modules; and plan accommodations for orbital maneuvering and orbital transfer vehicles.

Boeing — Teledyne Brown Engineering; General Electric; Vought; OAO; Thermacore; Garrett; Hamilton Standard; Life Systems; Lockheed; Umpqua; Perkin-Elmer; Fairchild; Aerojet; Rocketdyne; Rocket Research; Eaton; Sundstrand; Westinghouse; Rockwell Autonetics; TRW; Computer Tech Associates; Hughes; Telephonics; Camus.

General Dynamics — Grumman; Hamilton Standard; Life Systems; Ford Aerospace; TRW; Ball Aerospace; Computer Sciences; Otha C. Jean & Associates; Aerojet; Honeywell; RCA; Rocketdyne; SPAR Aerospace; Sperry; Telephonics.

Martin Marietta — McDonnell Douglas Technical Services; Hamilton Standard; Honeywell; Hughes; Hercules; Wyle Labs.

Work Package Two: Johnson Space Center, Houston — definition and preliminary design of the structural framework to which the various elements of the Space Station will be attached; interface between the Space Station and the Space Shuttle; mechanisms such as the Remote Manipulator Systems; attitude control, thermal control, communications and data management systems; plan for equipping a module with sleeping quarters, wardroom and galley; and plan for extravehicular activity (EVA).

Lockheed — TRW; Bendix; Hughes.

McDonnell Douglas — IBM; Honeywell; RCA; Ball Aerospace; Computer Sciences; Design West; Communications and Data Systems Associates; Eagle Engineering; Essex; Fluor; Ford Aerospace and Communications; Hamilton Standard; ILC Space Systems; SPAR Aerospace; LTV Aerospace and Defense.

Rockwell International — Grumman; Harris; Sperry; Intermetrics; SRI International.

Work Package Three: Goddard Space Flight Center, Greenbelt, Md. — definition and preliminary design of the automated free-flying platforms and of provisions to service, maintain and repair the platforms and other free-flying spacecraft; provisions for instruments and payloads to be attached externally to the Space Station; and plan for equipping a module as a laboratory.

General Electric — TRW; Essex; Integrated Systems Analysts; Perkin-Elmer; SPAR Aerospace; Teledyne Brown Engineering.

RCA — Lockheed; Ball Aerospace; Computer Sciences.

Work Package Four: Lewis Research Center, Cleveland — definition and preliminary design of the electrical power generation, conditioning and storage systems.

Garrett — Acurex; Advanco; University of Houston; Electro-Space; Mechanical Technology; Thermo Electron; LTV Aerospace and Defense; EBASCO Services; GA Technologies; Lockheed.

Rocketdyne — Sunstrand; Ford Aerospace and Communication; Harris; Lockheed; Spectralab; Acurex; Georgia Tech.

TRW — General Electric; Grumman; General Dynamics; Perkin-Elmer; United Technology; Mechanical Technology; Life Systems.

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Other Proposals:
Natural Energy Systems — ODC, Inc.

J. C. Gadouy

In addition to the study of the permanently manned Space Station, the RFP also requires contractors to study how those elements of the Space Station would change were the station originally man-tended rather than permanently manned. Contractors also will be expected to pay particular attention to recommendations of the NASA Advanced Technology Advisory Committee, which is identifying automation and robotic technologies which could be used in the Space Station.

Following completion of the 18-month definition and preliminary design contracts, NASA intends to move, in 1987, into final design and development of the Space Station. Proposers for the definition and preliminary design phase must have the capability to perform and manage the design, development and test phase (Phase C/D) of their appropriate work packages.

NASA Releases Commercial Use of Space Policy

NASA has announced its Commercial Use of Space Policy which contains a series of initiatives to reduce the technical, financial and institutional risks of doing business in space. Other initiatives to expand the level of private sector investment in space-related activities are explained in the policy statement.

To reduce technical risks, NASA will perform research oriented toward the development of commercial space technologies. To reduce financial risks, NASA will provide simplified and low-cost access to space as well as to ground-based NASA facilities. To reduce institutional risks, NASA will assist private firms in their joint endeavors with NASA and strive to maintain consistent policies regarding support of commercial space ventures.

In making the policy announcement, Isaac T. Gillam IV, Assistant Administrator for Commercial Programs, said the Office of Commercial Programs "will serve as the focus for an agency-wide program that will encourage private sector investment in space and asssist new high technology commercial space ventures." Gillam said the newly established office will consist of three divisions: Technology Utilization; Commercial Development; and Plans, Policy and Evaluation.

The Technology Utilization Division will seek to continue to enhance the transfer of NASA-developed technologies to U.S. industry through cooperative agreements, joint ventures or the information dissemination process.

The Commercial Development Division will be responsible for the negotiation and coordination of bilateral or multilateral agreements with aerospace and non-aerospace companies seeking access to NASA-developed technologies and facilities. This division will also seek to enhance the development of new advanced technology commercial markets which exploit the Space Shuttle and eventual Space Station capabilities.

The Plans, Policy and Evaluation Division will conduct the long-term strategic planning needed to support the development of agency policies that will facilitate expanded private sector investment in civil space and space-related activities.

The issuance of the NASA Commercial Use of Space Policy is in accord with actions recently taken by the administration and the Congress. On July 20, 1984, the administration issued the National Commercial Space Policy. During the most recent session of Congress, NASA's House and Senate Authorization Committees amended the NASA Space Act of 1958 directing the agency to "seek and encourage . . . the fullest commercial use of space."

Templeton Leaves NASA for Washington Law Office

Patrick A. Templeton, NASA Associate Administrator for External Relations since May 1983, joined the Washington office of Garvey, Schubert, Adams and Barer, a Seattle-based law firm, on Dec. 3.

Templeton came to NASA in September 1981, as Deputy Assistant Administrator for Legislative Affairs.

Before entering the government, Templeton was associated with the General Electric Co. He entered the firm's sales management program in 1965. He later became manager of Government Relations for the firm's Transportation and Communications Systems Divisions in Washington, D.C., and was serving as manager of Government and Community Relations for the Major Appliance Business Group in Louisville, Ky., when he joined NASA.

Unique Facility Aids Aviation Safety Research

A unique new NASA facility has made it possible for pilots to "fly" into crowded airports while under the direction of an air traffic controller, deal with other approaching aircraft, extreme weather conditions and even mechanical failures — all from the safety of the ground.

These ground-based studies of pilot responses, controller commands and air traffic operations plus evaluation of new procedures and systems will further improve safety in the air.

The Man-Vehicle Systems Research Facility (MVSRF), at Ames Research Center, Mountain View, Calif., is dedicated to the study of aviation human factors. This includes such things as pilot fatigue and stress, and complex operations. It allows study of the interaction among flight crews, their aircraft, air traffic control and as many as 36 other aircraft. This type of research has not previously been possible. Until MVSRF, simulators have been used primarily for developing and testing aircraft hardware and software systems, and for crew training, rather than for human factors research.

Human error plays a part in 60 to 80 percent of all aviation accidents, according to studies done by a number of organizations. The Ames facility allows scientists to study how errors are made, as well as how automation and advanced instrumentation affect human performance.

The Man-Vehicle Systems Research Facility allows complete simulation of flight missions. Observer stations are provided both inside the simulators' two transport aircraft cockpits and also at remote locations. From these observer stations, experimenters can introduce problems such as turbulence, traffic, fog or mechanical failure or otherwise modify planned scenarios during the simulation. Scientists can study how decisions made in the cockpit are affected by environmental and hardware problems and by availability of information (from the ground and from the aircraft) about flight status.

The facility houses two flight simulators which can be operated independently of each other or interactively as two aircraft flying in the same airspace. There is also a mock air traffic control station and pilot stations from which other aircraft can be entered into the network to give the pilots realistic air traffic situations.

One of the simulators, the Advanced Concepts Flight Simulator, represents technology for aircraft projected to be flying about 1995. This cockpit of the future has certain features which more resemble a modern office than a flight deck. It houses advanced technology, desk-top flight controls and displays that make use of small side-stick controls instead of the usual steering wheel and column, and cathode ray tubes with touch-sensitive panels for pilot interactions. The Advanced Concepts Flight Simulator was developed jointly by NASA and the Lockheed-Georgia Company.

Cockpit simulator enables the crew to experience the "seat-of-the pants" feel of flight.

The other simulator is a replica of the cockpit of a Boeing 727 Series 200, complete with pilot, co-pilot and flight engineer's stations and flight displays and control systems. It is capable of providing motion in six degrees: forward and backward, upward and downward, sideward, pitch, roll and yaw, enabling the crew to experience the "seat-of-the-pants" feel of the flight. The 727 Simulator was built by Singer-Link of Binghamton, N.Y.

A complete visual system provides out-the-cockpit-window displays for the two simulators. The displays can depict approaching aircraft and the entire landscape of many of the major airports in the United States. They can also provide dusk, night, fog, clouds and many other weather conditions. Unusual locations such as seascapes or mountainous terrain can also be provided for simulator "pilots."

Auditory cues complete the realism with the sounds of aircraft engine operation, landing gear extension, aerodynamic noise and runway effects.

New Space Shuttle Booster Motor Successfully Test Fired

NASA's prime contractor for Space Shuttle solid rocket booster motors has successfully static fired a new, lightweight version of that motor in northern Utah. The test was conducted under the direction of NASA's Marshall Space Flight Center in Huntsville, Ala.

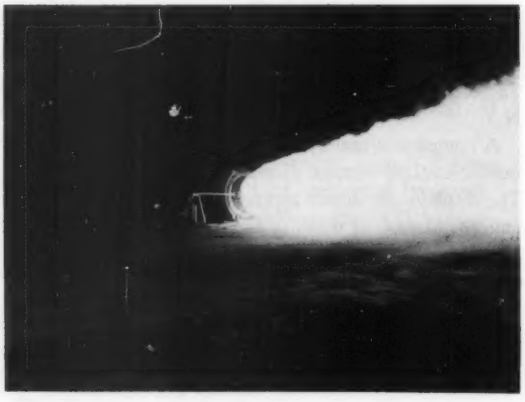
Preliminary results from the two-minute firing at Morton Thiokol's Wasatch Division near Brigham City, Utah, indicate that all objectives were met and the system operated as expected.

The case of the new motor is made from a composite material of plastic reinforced with graphite fibers wound into a cylinder. Each of these filament-wound cases weighs about 30,000 pounds less than the current steel case that makes up most of the length of the Shuttle's solid rocket booster. Use of the lighter cases will increase Shuttle payload carrying capacity about 4,600 pounds.

Two more of the filament-wound booster motors will be test fired by Morton Thiokol in the spring and summer of 1985. Also in the spring of 1985, flight motor segments containing filament-wound cylinders will be shipped to Vandenberg Air Force Base, Calif., for use by NASA and the U.S. Air Force in the first Shuttle launch from Vandenberg planned for October 1985.

Following that launch, the boosters will be retrieved from the Pacific Ocean and the motor case components will be returned to Utah for inspection and analysis.

The filament-wound motor cases are built for Morton Thiokol as a joint venture by Hercules, Inc., of Magna, Utah, and Votaw Precision Tool, Inc., of Santa Fe Springs, Calif.



Booster motor firing in northern Utah.

Astronaut Don Peterson Leaves NASA

Astronaut Donald H. Peterson has announced his intention to resign from NASA by the end of the year.

Peterson was selected as an astronaut in August 1969. He was a crew member on the sixth Space Shuttle mission in April 1983. That was the first flight of the orbiter Challenger, during which he and astronaut Story Musgrave performed the first Shuttle-era extravehicular activity.

Peterson, a retired Air Force colonel, plans to work as an aerospace industry consultant. He and his family will continue to reside in the Houston area.

NASA Seeks Proposals for F-8 Oblique Preliminary Design

NASA's Ames Research Center, Mountain View, Calif., has issued a Request for Proposal (RFP) for the preliminary design phase of a joint NASA/Navy program to design, construct and evaluate an oblique wing during supersonic flight research conditions. The feasibility study was completed in 1983.

The oblique wing concept allows an aircraft's straight wing to be rotated in flight to achieve either efficient low speed maneuverability and long loiter time — or supersonic cruise flight.

This program is a follow on to the subsonic AD-1 first manned oblique wing aircraft flight research program conducted by NASA Ames-Dryden from late 1979 through 1982.

The RFP is for Phase B of a four-phase procurement program for modifying the NASA F-8 Digital Fly-By-Wire research aircraft to a supersonic oblique wing configuration. This phase of the program will provide the preliminary design for the oblique wing, its pivot assembly and a set of software flight control laws for use in the F-8's flight computers. It also will define the aircraft's flight performance and assess its operational capabilities for potential naval applications.

NASA officials expect that two or more contractors will be selected to perform the preliminary design work through the competitive procurement process.

Near the end of the preliminary design work, a second RFP, Phase C, will be issued in order to select a single contractor from the Phase B participants for

detailed design work. This phase will also include fabrication and ground testing and will be followed by the Phase D flight support contract. An initial 12-month flight test program consisting of about 40 flights is planned, followed by additional flight research investigation.

The goal of the NASA/Navy program is to validate oblique wing technology in flight regimes that are representative of versatile operational aircraft. Specifically, this would include the successful design, fabrication and flight test of a composite, aeroelastically tailored oblique wing. Such a composite wing would be constructed in a manner so that the bending stresses of flight would not degrade the wing's aerodynamic efficiency. In addition, the program seeks to demonstrate the versatility and efficiency of the oblique wing for typical military and civilian applications, including Navy fleet operations, by exhibiting efficient supersonic cruise, subsonic loiter and effective maneuvering.

Flight testing of the F-8 oblique wing aircraft will occur at NASA's Ames-Dryden Flight Research Facility, Edwards, Calif.

Artist's concept of F-8 oblique wing.

How A Gas Burns in Space is Target of Zero-G Flights by Lewis Lear Jet

Zero-gravity trajectories are putting Lewis Research Center's Lear jet, a college student and several Lewis engineers to a unique test as a combustion experiment is flown aboard the aircraft.

The project, which is pioneering research into the effects of weightlessness on the flammability of various gases, was developed by the University of Illinois at Urbana-Champaign and funded by the NASA Office of Space Science and Applications.

Evaluation of the combustion experiment's success during the next year will determine the feasibility of placing the package on a future Shuttle mission to study longer-duration effects of weightlessness on combustion.

According to Lewis Project Manager Ralph Nussle of the Shuttle Experiments Branch, Lewis involvement in the zero-G aircraft experiments is threefold: technical support to the university for design and fabrication of the apparatus, integrating the experiment on the Lewis plane and flying a planned 15 missions.

With the aid of Lewis, Professor Roger Strehlow, recently retired professor of aeronautical and astronautical engineering at the University of Illinois and leader of the investigation, and graduate student Kurt Noe have designed an experimental apparatus shaped like a rectangular open-sized box. Inside are eight 2-inch-diameter tubes, each 30 inches long, arranged vertically around the edge of a rotating rack.

Strehlow said scientists have determined mathematically that flame should propagate more slowly under conditions of weightlessness, but thus far, there have been no actual tests of that theory.

The combustion experiment being flown, a test unique in its concept, is looking at what Lewis' Nussle termed, "the perplexing question of the effects of a zero-G environment on the flammability of methane and air. The researchers will examine the flammability limits of those gases to find the leanest mixtures that will support a flame when ignited. A primary objective of the experiment is to shed new light on fundamental combustion science."

"There is some question about combustion hazards in a space environment," Strehlow said. "Therefore, the more we know about flammability, the better off we'll be. This understanding could also lead to safer terrestrial combustion operations in industry and more efficient auto engines."

Strehlow explained that the advantage of these in-flight experiments over previous zero-G flammability studies is their extended duration. Weightlessness was maintained in earlier drop tower tests only for about two seconds. The Lear jet experiments will provide more than 20 seconds of weightlessness.

The plane begins its low-G trajectory with a 2 1/2-G pull-up maneuver at an altitude of 11,000 ft. and a speed of 415 miles per hour. Achieving a 50-degree angle of attack, it begins to climb in a parabolic arc. By throttling back the engines almost immediately after it has begun to climb, a condition of weightlessness is achieved for 22 to 25 seconds during the rest of the climb and as the plane passes through the top of its trajectory at 18,000 ft. and begins its descent. The recovery maneuver then begins, and the pilot performs a 2-G pull-out maneuver at 11,000 ft.

Aboard the plane, in addition to the pilot and copilot, are graduate student Noe and a NASA engineer. They are responsible for conducting the experiments and

Patents for Inventions from NASA Research

The Office of General Counsel, NASA Headquarters, announces the following U.S. patents have been issued by the U.S. Patent Office and Trademark Office to NASA for inventions resulting from NASA research. Inquiries concerning them should be directed to the attention of the NASA Patent Counsel of the indicated installation.

Inventor(s) & Employer	Title	Patent No.	Installation
Richard M. Day, NASA/GSFC	Portable pallet weighing apparatus	4,479,560	GSFC
Garland D. Johnston, Archie D. Coleman, Joseph N. Portwood, Jerry M. Saunders, John W. Redmon, NASA/MSFC; Allen C. Porter, Teledyne-Brown Engineering Co., Huntsville, Ala.	Insulation bonding test system	4,479,386	MSFC
Gordon A. Wiker, Caltech/JPL, Pasadena, Calif.	Automatic multi banking of memory for micro-processors	4,481,570	NRO-JPL
Lynn M. Anderson, NASA/LeRC	Solar energy converter using surface plasma waves	4,482,778	LeRC
Lynn M. Anderson, NASA/LeRC	Inelastic tunnel diodes	4,482,779	LeRC
Bruce McCandless, NASA/JSC	Connection system	4,483,639	JSC
Donald F. Drapeau, Hamilton Standard, Windsor Locks, Conn.	Slow opening valve	4,483,512	JSC
Larry G. Evans, Computer Science Corp., GSFC, Greenbelt, Md.; Jacob I. Tromka, NASA/GSFC	Method and apparatus for mapping the distribution of chemical elements in an extended medium	4,483,817	GSFC
Stephan Stecura, NASA/LeRC	Thermal barrier coating system	4,485,151	LeRC

making visual observations.

A secondary project is to assess the ability of jet pilots to hold a zero-G trajectory, the accuracy of which is crucial to the experimental data.

As the jet holds a particular trajectory, one end of each of the eight plexiglas tubes on the rotating apparatus will be opened and the gas mixture ignited at that end. As the combustion wave passes through the tube, it will be photographed by a movie camera.

Nussle explained that a series of 15 flights is necessary because each flight will permit only six dive sequences due to the Lear's limited fuel capacity. Since zero-G conditions require the plane's main tank to be kept full to avoid an engine stall, the plane must return home when the wing tanks are emptied.

According to Nussle, extensive modifications have been made to the Lear to accommodate for the higher speeds and sharper dives the plane encounters.

Noe accompanies the experiment during the flights to initiate the ignition of the flammable gases and collect data. Joining Noe on the science end of the flights from Lewis, on an alternating basis, are aerospace engineers Kurt Sacksteder and Dan Vento. Like Noe, they underwent training to stand up to the rigors of zero-G.

KSC Seeks 30 College Students for Summer Program

Kennedy Space Center is searching for 30 college sophomores, juniors or seniors majoring in life sciences, engineering, agriculture or horticulture to participate in a six-week summer Space Life Sciences Training Program (SLSTP).

Applicants for this first year's pilot program should be enrolled in universities with a predominantly minority student body or in universities located in Florida. Students who are winners of the Shuttle Student Involvement Program (SSIP) or are recommended by principal investigators involved in Spacelab Life Sciences 1 may also apply.

"We designed the program to stimulate student interest in life sciences, especially space biology and medicine," said Tom Perry, Chief of the Life Sciences Flight Experiments Program and architect of the project, "and we feel the SLSTP is fully consistent with the President's directive to strengthen the nation's commitment to science and technology education."

The program is sponsored by the Office of Space

Science and Applications' Life Sciences Division and the Office of Equal Opportunity Programs and is supported by the Office of Space Flight. Course credit for the program will be awarded through Florida A&M University, which provides administrative support for the project.

The winners will be housed at the University of Central Florida in Orlando while they work at Kennedy designing a flight experiment. The group will participate in each phase of flight development — including preflight preparation, inflight activities and postflight analysis and evaluation.

The 1985 program starts June 17 and ends July 26. This first group of students will develop three experiments targeted for launch aboard Space Shuttle mission 51-L in July 1985. The three experiments are a study of the effects of gravity on plant growth and development, a preflight and postflight test of hearing organ function using the human sled developed for Spacelab, and a test of a controlled delivery system for plant nutrients. Future summer projects may use a variety of hardware from the Life Sciences flight program, including a plant growth unit, the human sled and a monitor used to determine facial pallor and blood flow in weightlessness.

Project managers are soliciting applicants now. Winners will be notified soon after final selections are made in late April.

Headquarters managers for the project are Tom Perry, Chief of Life Sciences Flight Programs, and Dr. Harriett Jenkins, Assistant Administrator for Equal Opportunity Programs. The KSC project manager is Bill Munsey, Flight Systems Management Office. Dr. Irene Long, KSC Biomedical Office, is the technical director. Life Sciences contractor Bionetics Corp. also supports the program at KSC.

Crippen Named Flight Crew Operations Deputy Director

Robert L. Crippen, veteran Space Shuttle commander, has been named deputy director of Flight Crew Operations at NASA's Johnson Space Center in Houston.

The appointment was effective Oct. 15. Crippen will serve as deputy to George W. S. Abbey. He will remain an active astronaut.

Crippen, a Navy Captain, was commander of Shuttle mission 41-G in October. He was pilot on STS-1, the first Space Shuttle flight, and commanded STS-7 and 41-C, the Solar Maximum satellite repair mission. He joined NASA in September 1969, after a three-year assignment with the Air Force's Manned Orbiting Laboratory program.

He received his commission through the Navy's Aviation Officer Program at Pensacola, Fla., and continued flight training in Florida and Texas. He served as a fighter pilot assigned to the carrier USS Independence from June 1962 to November 1964.

He later attended the Air Force Aerospace Research Pilot School at Edwards Air Force Base, Calif., where he remained as an instructor pilot until his selection in October 1966 to the MOL program.

His other work at NASA included participation in the Skylab Medical Experiments Altitude Test and serving as a member of the astronaut support crew for Skylab missions 2,3 and 4 and the Apollo-Soyuz Test Project.

What's New in NASA Radio Programming

Programs released in November:

Space Story (4½-minute programs):
"Space Station for Astrophysics" (featuring Dr. Dave Black, Ames Research Center)
"Future Interplanetary Spaceships" (featuring Dr. Franklin Chang-Diaz, astronaut)
"First Photographs of a Possible Solar System" (featuring Dr. Geoffrey Briggs, NASA Headquarters)
"Rings Around Uranus Photographed for the First Time" (featuring Dr. William Brunk, NASA Headquarters)

Special Report (14½-minute program):
"First Photographs of a Possible Solar System" (featuring Dr. Geoffrey Briggs, NASA Headquarters)

NASA's radio programs are sent to approximately 3,500 radio stations across the nation; in addition, translations of the recordings are made by Voice of America and Radio Free Europe and these tapes are then released to the appropriate audiences overseas. Released each month are one report of 14½ minutes and four 4½-minute weekly stories (one story in the set is featured for one week of the month). Ten one-minute space notes are released quarterly.

Johnson Counselor Honored

Constance R. Alexander, an employee relations specialist at NASA's Johnson Space Center, Houston, was recently named 1984 American Business Woman of ABWA (American Business Women's Association). The award is presented annually by ABWA for advancement in business with consideration given to continuing education and involvement in community affairs. Alexander was selected from a field of more than 2,100 business women.

After losing her sight and first career as an educator, Alexander served two years as an adult ex-offender counselor for the National Alliance of Business while developing her second career at Johnson.

Alexander received her B.A. degree from North Texas State University and completed 18 hours of postgraduate work there. She received an M.A. degree in literature from Wake Forest University and another M.A. in clinical psychology from the University of Houston at Clear Lake.

In addition to her membership in ABWA, Alexander's community involvement ranges from lecturing high school students to membership in the Daughters of the American Revolution, supporting Mothers Against Drunk Drivers (MADD), participating in career day and career counseling at the Lighthouse for the Blind and hosting a rape seminar for Federal Women's Week.

Increases Noted in Employee Suggestion Program

NASA's efforts to revitalize the Employee Suggestion Program (ESP) are reaping benefits both to the agency and its employees. Agency-wide, the number of suggestions received increased from 396 in fiscal year 1983 to 1,095 in 1984.

Kennedy Space Center, Fla., led the installations with an increase of almost seven times its 1983 suggestions, and Johnson Space Center in Houston received more than four times its 1983 number. Other installations more than doubling the previous year's suggestions were Goddard Space Flight Center, Greenbelt, Md.; Lewis Research Center, Cleveland; Marshall Space Flight Center, Huntsville, Ala.; and the National Space Technology Laboratories near Bay St. Louis, Miss.

First year tangible savings to NASA also increased significantly to $3,504,000 — better than six times the 1983 amount. For their adopted ideas, 191 NASA employees received awards totaling $60,772.

One example of a money-saving idea was the suggestion submitted by Lawrence D. Blackshear of Johnson Space Center. While serving as Head of the T-38 Aircraft Quality Assurance Section in the Aircraft Operations Division, Blackshear initiated a proposal to eliminate side force controls attached to the lower wing surfaces of the two Shuttle Training Aircraft (STA). STAs are planes designed to simulate the Space Shuttle orbiter in its return-to-Earth mode and are major elements in the flight training of the astronauts. The side force controls originally were incorporated in the STAs in an effort to maximize the simulation fidelity of the training aircraft by providing lateral acceleration to match the Shuttle model. However, after several flights of the orbiter vehicle, Blackshear became convinced the side force controls were unnecessary. Since Johnson was beginning negotiations for the design and fabrication of a third STA, Blackshear recognized the potential for substantial cost savings if the side force control requirement was eliminated. After a thorough analysis a decision was made to terminate the procurement of side force controls for the third STA.

Total first-year savings, after deducting the cost of removing the existing side force controls from the first two STAs, was $870,000, and on Aug. 20, 1984, Blackshear was presented an award of $5,525.

Lawrence D. Blackshear (second from right) receives Suggestion Award. With him (from the left) is Johnson Space Center Director Gerald D. Griffin, Mrs. Blackshear and George W. S. Abbey, Director of Flight Crew Operations at Johnson.

1984 Launch Activity

Space Shuttle Launches

Date	Mission	Orbiter	Launch Site*	Remarks
Feb. 3	41-B	Challenger (OV-099)	KSC	Payload: SPAS-01A, Palapa B-2, Westar-VI; successful launch; landing at KSC, Feb. 11.
April 6	41-C	Challenger (OV-099)	KSC	Payload: Solar Maximum Repair Mission; Long Duration Exposure Facility; successful.
Aug. 30	41-D	Discovery (OV-103)	KSC	Payload: LEASAT-1, Telstar 3-C, SBS-D, OAST-1; first flight of Discovery; successful.
Oct. 5	41-G	Challenger (OV-099)	KSC	Payload: OSTA-3, ERBS; successful.
Nov. 8	51-A	Discovery (OV-103)	KSC	Payload: Telesat-H, LEASAT, DMOS: retrieved Palapa B-2 and Westar IV; successful.

Satellite Deployments from the Shuttle

Date	Satellite	Deployment Device/** Upper Stage	Shuttle Mission	Remarks
Feb. 3	Westar-VI	PAM-D	41-B	Western Union communications; successful deployment from STS 41-B; satellite failed to achieve geosynchronous orbit.
Feb. 6	Palapa B-1	PAM-D	41-B	Indonesia communications: successful deployment from STS 41-B; satellite failed to achieve geosynchronous orbit.
April 7	LDEF	RMS	41-C	Long Duration Exposure Facility; successful deployment.
Aug. 30	SBS-D	PAM-D	41-D	Satellite Business Systems commercial communications; successful deployment.
Aug. 31	LEASAT	UUS	41-D	Navy communications; successful deployment.
Sept. 1	Telstar 3-C	PAM-D	41-D	AT&T communications; successful deployment.
Oct. 1	ERBS	RMS	41-G	Earth Radiation Budget Satellite; successful deployment.
Nov. 9	Telstar	PAM-D	51-A	Canadian communications; successful deployment.
Nov. 10	LEASAT	UUS	51-A	Navy communications; successful deployment.

Expendable Launches

Date	Mission	Launch Vehicle	Launch Site	Remarks
March 1	Landsat 5	Delta	WSMC	National Oceanic and Atmospheric Administration; earth observation; successful launch.
June 9	Intelsat V-G	Atlas Centaur	ESMC	Intelsat international communications; satellite not in proper orbit due to Centaur stage malfunction.
Aug. 16	AMPTE	Delta	ESMC	Active Magnetospheric Particle Tracer Explorer; space physics — NASA cooperative with Germany; successful launch.
Sept. 21	Galaxy-C	Delta	ESMC	Hughes commercial communications satellite.
Nov. 13	NATO-IIID	Delta	ESMC	North Atlantic Treaty Organization communications; successful launch.
Dec. 12	NOAA-F	Atlas-F	WSMC	National Oceanic and Atmospheric Administration weather satellite; successful launch.

* **Launch Sites:** ESMC — Eastern Space and Missile Center, Fla.; KSC — Kennedy Space Center, Fla.; WSMC — Western Space and Missile Center, Vandenberg Air Force Base, Calif.

** **Separation Device/Upper Stage:** IUS — Inertial Upper Stage; PAM-D — Payload Assist Module; RMS — Remote Manipulator System; UUS — Unique Upper Stage.

Another Dividend from Air and Space

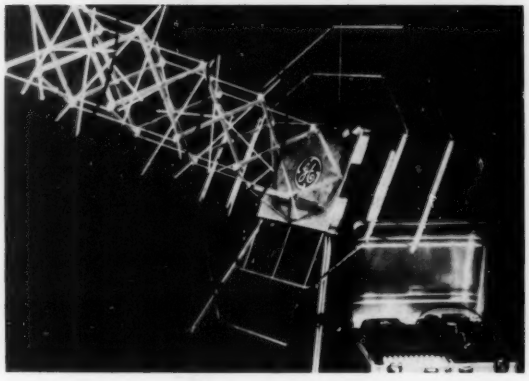
Research and development in aeronautics and space have provided numerous benefits for all Americans—and at a tiny percentage of the tax dollar. Here is an example:

Suitcase Communicator

The equipment pictured is a portable communications system designed to relay messages over long distances by satellite. A joint development of NASA's Ames Research Center, Mountain View, Calif., and General Electric Co., Schenectady, N.Y., it consists of a collapsible antenna and a computerized transceiver, a terminal for sending and receiving messages. The whole system fits into two Pullman-size suitcases and can be powered from a conventional outlet or a vehicle's battery.

Use of satellite relay permits transmissions in almost any terrain, even in areas where mountains block normal line-of-sight transmission. In initial tests, the relay spacecraft was NASA's Applications Technology Satellite direct broadcast satellite. With ATS-3, an operator anywhere in North or South America and most of the Atlantic and Pacific Oceans can communicate with fixed Earth statioins in those areas. If a network of compatible satellites were available, the system could be used globally.

The principal use envisioned is communications in disasters and other emergencies where it is necessasry to get short but vital messages out of the emergency area. The 1980 eruption of Mount St. Helen's illustrated the need for rapidly deployable long distance communications not dependent on wirelines, because such lines are often destroyed in disasters. Another application is long-range communications between transportation vehicles and their dispatch offices. In a seven-month test concluded last year, drivers of Smith Transfer Corp. cross country trucks exchanged information via satellite with their dispatchers in Staunton, Va. The drivers reported excellent communications except on brief occasions where trees or overpasses blocked line-of-sight transmissions. Such a communications system offers advantages to the trucking industry in keeping track of equipment, improving maintenance schedules, avoiding improper routing and reducing theft losses.



The system is alphanumeric, meaning that messages are sent and received in letters and numbers. The operator types a message on a keyboard, then transmits it to the Earth station by punching a single key. Another keystroke enables him to receive messages stored at the Earth station. The terminal can be set up in two minutes. The antenna is unfolded and pointed toward the satellite; the proper direction and elevation are available from a simple chart.

ATS-3 is 17 years old and nearing the end of its useful life, but if enough public service and commercial applications are found, the system could be redesigned to work with other satellites. Mobile Satellite Corp., King of Prussia, Pa., plans to build and operate such a satellite; the company has filed an application with the Federal Communications Commission for a frequency allocation.

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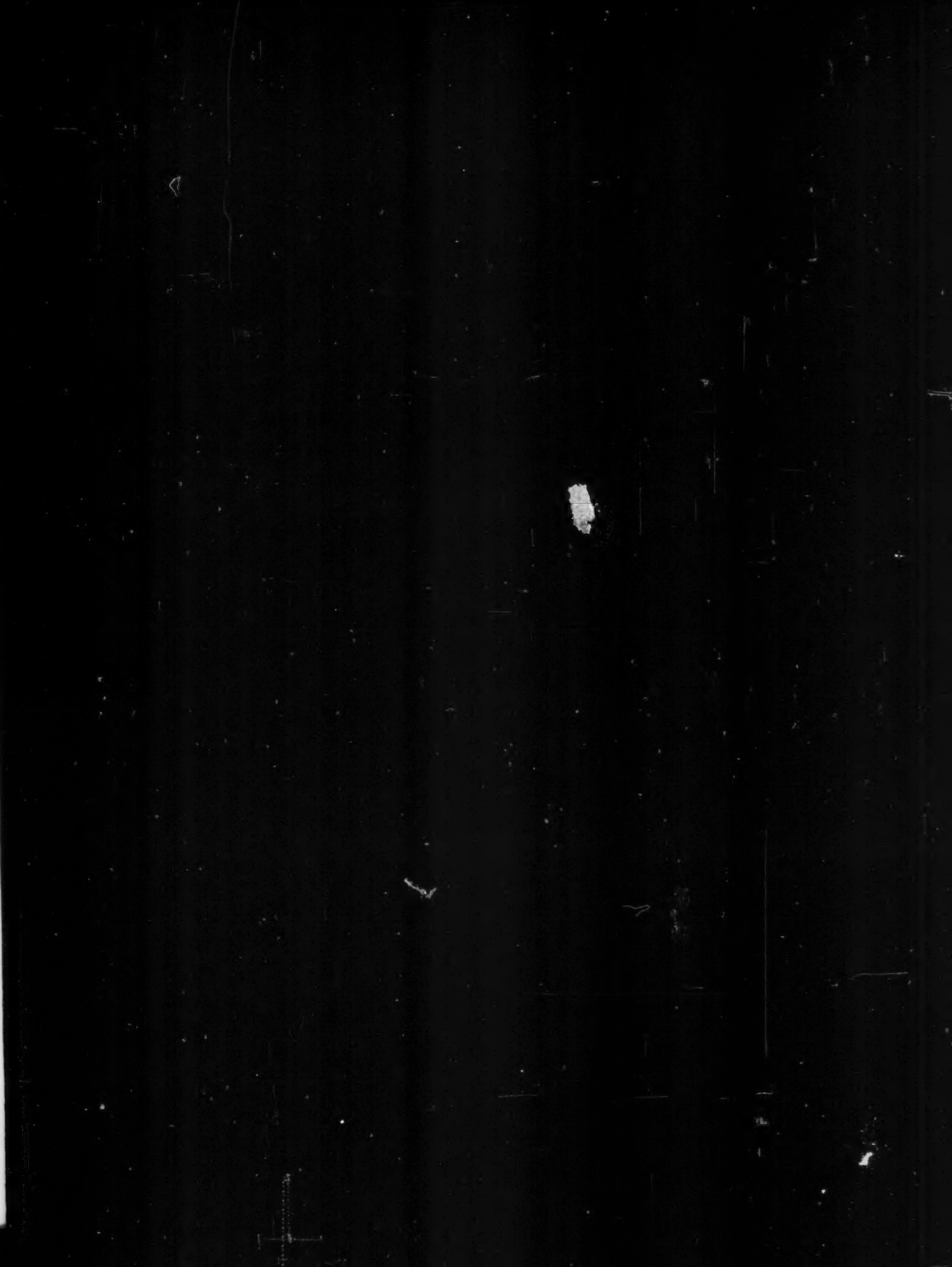
* NASA does not endorse commercial products developed as a result of its Technology Utilization or Patent Licensing Programs, but it does encourage the widest possible use of its technology.

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